### Chapter 300

### Bases - 13

This chapter is not part of the Project's specifications, but is a guide for project personnel in interpreting CDOT specifications, understanding ASTM, AASHTO and Colorado test procedures (CPs), and for completing CDOT forms.

The design and construction of a pavement structure may include one or more base courses. A base course is a layer of material below the wearing surface of a pavement. Bases may be constructed of gravels, mixtures of soil and aggregate, mixtures of asphalt and aggregate, mixtures of cement and aggregate or soil, or other innovative materials. Bases may be made of unbound materials, such as gravel, or bound materials, such as lime treated subgrade.

Base courses under concrete pavements provide a drainage layer, reduce pumping, provide protection against frost damage, and provide support for the heavy equipment used for placing concrete pavements. There is some increase in structural capacity when a base is placed under a concrete pavement, but it is typically not a significant amount.

Base courses under flexible pavements provide a significant increase in structural capacity. Pavement design of flexible pavement depends on the wheel loads being distributed over a greater area as the depth of the pavement structure increases. There are the added benefits of improved drainage and protection against frost damage.

# ITEM 206 STRUCTURE BACKFILL ITEM 304 AGGREGATE BASE COURSE

Compaction of unbound bases is important for the stability of the pavement it supports. The maximum dry density is established in the laboratory before construction. During construction measurements of the base dry density are compared to the maximum dry density. The requirements for compaction of

aggregate base course (ABC) are shown in Subsection 304.06 of the Standard Specifications for Road and Bridge Construction. Structure Backfill has similar requirements as shown in Subsection 206.03.

Two methods to determine maximum dry density of soils are AASHTO T 99 and AASHTO T 180. AASHTO T 99 is similar to ASTM D 698 and is commonly referred to as the Proctor Test, as it was first proposed by R. R. Proctor in 1933. AASHTO T 99 uses a 5.5 lb. rammer dropped from 12 in. When a 4 in. mold is used, three layers are compacted with 25 blows on each layer. When a 6 in. mold is used, three layers are compacted with 56 blows on AASHTO T 99 results in a each layer. compactive effort of 12,400 ft-lbf/ft<sup>3</sup>. AASHTO T 180 is similar to ASTM D 1557 and is commonly referred to as the Modified Proctor Test. AASHTO T 180 uses a 10 lb. rammer dropped from 18 in. When a 4 in. mold is used, five layers are compacted with 25 blows on each laver. When a 6 in, mold is used, five lavers are compacted with 56 blows on each layer. This results in a compactive effort of 56,000 ft-lbf/ft<sup>3</sup>. Comparing compactive efforts, AASHTO T 180 produces four and a half times the compactive effort than a sample receives compacted according to AASHTO T 99.

AASHTO T 99 is the appropriate standard for compaction of cohesive soils, particularly if there is the potential for swelling when saturated. AASHTO T 180 is appropriate for granular soils, such as aggregate base course and Structure Backfill, Class 1.

There are four methods of determining moisturedensity relationships by AASHTO T 180:

- Method A uses a 4 in. mold and the fraction of the soil passing a No. 4 sieve. AASHTO states that this is applicable to soil mixtures that have 40% or less retained on a No. 4 sieve.
- Method B uses a 6 in. mold and the fraction of the soil passing a No. 4 sieve. AASHTO

states that this is applicable to soil mixtures that have 40% or less retained on a No. 4 sieve.

- Method C uses a 4 in. mold and the fraction of the soil passing a 3/4 in. sieve. AASHTO states that this is applicable to soil mixtures that have 30% or less retained on a 3/4 in. sieve.
- Method D uses a 6 in. mold and the fraction of the soil passing a 3/4 in. sieve. AASHTO states that this is applicable to soil mixtures that have 30% or less retained on a 3/4 in. sieve.

The gradation requirements for Class 1 Structure Backfill and ABC are shown in Subsections 703.08 and 703.03 respectively. A review of the gradation requirements shows that many granular materials will meet the gradation requirements and exceed the limits of application stated in AASHTO T 180.

Colorado has developed a rock correction formula in Colorado Procedure 23 (CP 23) when AASHTO T180 is used:

$$MDD = (P_f \times D_f + P_c \times 0.95 D_c)/100$$

The standard practice within the Department follows:

- 110 lbs. of granular material are sampled and sent to the laboratory before construction begins. This would typically require two standard sample bags.
- The material is separated into two fractions, material retained on a No. 4 sieve and material passing a No. 4 sieve.
- The specific gravity and absorption of the material retained on a No. 4 sieve is determined according to AASHTO T 85 Specific Gravity and Absorption of Coarse Aggregate.
- The maximum dry density and optimum moisture of the material passing a No. 4

- sieve is determined according to AASHTO T 180, Method A.
- For bases with crushed concrete or reclaimed asphalt pavement (RAP), an accurate specific gravity determination is difficult to make. For these materials T 180, Method D is used.
- Method D may be used if more than 30% of the material is retained on the No. 4 sieve, but has 30% or less of the material retained on the ¾ inch sieve. When Method D is used, use the above procedure but substitute the 3/4 inch sieve for the No. 4 sieve.

During construction the control of compaction follows according to the plans, specifications, and the Frequency Guide Schedule for Minimum Materials Sampling, Testing and Inspection. Each field test must include a separation of the sample into the two fractions, material retained on a No. 4 sieve and material passing a No. 4 sieve. Percent relative compaction is determined according to CP 25. CP 23 is used to correct the maximum dry density and optimum moisture for soil-rock mixtures with more than 5% material retained on a No. 4 sieve.

### ITEM 308 PORTLAND CEMENT & FLY ASH

Sources of portland cement and/or fly ash are listed on the Department's Approved Product List. To verify a specific cementitious material that may be considered for a project check if the supplier / manufacturer of the cement or fly ash is on the Approved Products List at the web site address of:

#### www.coloradodot.info/business/APL/

If a manufacturer wants to add a cement or fly ash source use the same web site and follow the instructions within Notice to Manufacturers and also follow all references within CP 11.

## **CDOT Forms - Applicable for Bases, Examples and Instructions**

Form	Title	Page
# 157	Field Report for Sample Identification or Materials Documentation	4 – 8
# 6	Field Tests of Base Aggregate, Fillers, Paving and Miscellaneous Aggregates	9 – 10
# 38	Aggregate Test Report	11
# 194	Structure Backfill Density Report	12
# 564	Soils and Aggregate Sieve Analysis When Splitting On the No. 4 Sieve	13 – 14
# 565	Sieve Analysis For Aggregate Not Split On the No. 4 Sieve	15 – 16
# 633	Sample Tag (Sacks)	17
# 1126	Stabilometer Record of Item 304 Aggregate Base Course	18
# 1296	Granular Materials Moisture – Density Report	19 – 21

COLORADO DEPARTME				Field sheet		Date
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ORADOD LD TEST VING AN	Date 20	12/20						•	Spec. deviations:  ves	Items: 206 Structure Backfill Class 1 206 Filter Material Class	304 ABC Class 6 307 Filter Type 403 HBP Grading	409 Cover Coat 410 Plant Mix SC Type Other Material:	
PA PE PA	Test #	-2							Spec	Items: 206 Str 206 Filts	304 AB 307 Filk 403 HB	409 Co 410 Pla Other №	

Colorado Department of Transportatio Project ID: 11925 AGGREGATE TEST REPORT Project: IM 0253-151 Location: SH 7 to WCR 16 Field Sheet No: 149102 Date Sent: 12/24/2003 **Date Submitted** 12/23/2003 Pit Owner: **DUNES PARK** Item Number: 304 Region: 04 Aggregate Test Report Sampled From: WINDROW Materials Description: **CLASS 3 ABC** Central Lab Test No.: 2003937X Project ID: **SPECIFICATIONS** (Grading AASHTO - T27) Passing 6 100% 6 Inch (152.4 mm) Passing 4 100% Inch 4 Inch (101.6 mm) Passing 3 Inch 100% 3 inch (76.2 mm) Passing 2 1/2 Inch 100% 2 1/2 Inch (63.5 mm) **Passing** 2 Inch 86% 2 Inch (50.8 mm) Passing 1 1/2 80% Inch 1 1/2 Inch (38.1 mm) 72% Passing 1 Inch 1 Inch (25.4 mm) Passing 3/4 Inch 67% 3/4 Inch (19.0 mm) Passing 1/2 Inch 61% 1/2 Inch ( 12.7 mm) Passing 3/8 Inch 57% 3/8 Inch (9.51 mm) Passing #4 47% #4 (4.75 mm) Passing #8 35% #8 ( 2.36 mm) Passing #16 23% #16 ( 1.18 mm) **Passing** #30 14% #30 600 mu) **Passing** #50 7% #50 300 mu) #100 Passing 4% #100 150 mu) Passing #200 3.3% 20 MAX. #200 75 mu) Fractured Faces (CP45): Abrasion (%Wear) (T96):: Liquid Limit (T89): NV Plastic Limit (T90): \* Indicates Deviation from Plastic Index Specification Requirements. (T90): NΡ "R" Value (T190): Bulk sp.g.: Fine Aggregate App. sp.g.: % Abs.: Course Aggregate Bulk sp.g.: App. sp.g.: % Abs.: Remarks: CC: Central Laboratory Glenn Frieler Regional Materials Engineer Concrete/ Physical Properties Program Manager CDOT FORM #38 1/2000

COLORADO DEPARTMENT OF TRANSPORTATION STRUCTURE BACKFILL DENSITY REPORT	Proj. locat	IM O2	253-151 SH 7 to	W/CD 1
DENSITY REPORT	Date 2	/14/03	ori / IU	Region 4
	Project co	de (SA#)	925	
Major Structures				
Number of Structures: (1 test/200 cu. yds.; minimum 1/structure)	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 1910	1350	7	560	3
Cross Drains				
Number of Cross Drains: (1 test/200 cu. yds.; minimum 1/structure)	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 1800	1800	10		
Side Drains				<u> </u>
Number of Side Drains: (1 test/200 cu. yds.; minimum 1/structure)	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 750	<b>450</b>	6	300	6
Other	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Remarks				
Discoult and the second	Title	F/0c :	Tech II	· · · · · · · · · · · · · · · · · · ·
Fidel Gonzalez	·	F/P5	iech iii	

			F TRANSPO			VI AGI	Project Project	no. IA	A 0253-151
			ON THE				Item 3		11925
						V C			
Pit name	<u>Goose F</u>	laven	38	5+8	0	,	Test no.	3	Sample weight 70 Date 10/10/03
Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs	Liquid limit	NV	Moisture correction
							Plastic limit	NP	Plus #4 moisture sample
							Plastic index		1587.0
<u>2 1/2</u>	2		0.0		100.0	100	· idolo ilido	' NP	Dry weight 1545.0
2 1 1/2	1.92	1.87	0.0 3.9		100.0	95-100	Soil class.	N/A	Loss 42.0
<u>1 1/2</u> 1	10.28	10 01	20.8		96.1 75.3		"R" value		% moisture
<del>3</del> /4	4.26	4.15	8.6		66.7		., , , , , ,	80	584.0
1/2	4.24	4.13	8.6	1	58.1		Sampled by		Wet weight 560.0
3/8	1.57	1.53	3.2	]	54.9		Tested by		Loss 24.0
+ #4	4.83	4.70	9.8		45.1	30-60			% moisture 4.3
- #4 Total	22.60 49.70	48.06	45.1 100.0	# 8 # 50	40.2				
Total	17.70	10.00	100.0	#200	9.3	5-12			
		Minus	#4 wash	172.00	7.0	0-12			
Vet weight grams)	Sieve	Weight (grams)	Individual percentage		Percent passing				
	# 8	61	10.9		89.1		W/oi	ahina	Individually
ry weight	# 50	282	50.3		38.8		W E	griirig	Individually
grams)	#200	101	18.1		20.7				
			207	l		1			
560	- #200 Total	116 560	20.7						
	Total	560	20.7 100.0	e con	nnleted in	rase a che	ck is nece	assany	
NOTE: S	Total	560	alculations a	re con	npleted in a	case a che			Sample weight   Date
NOTE: S	Total Save all mate	560 erial until ca	alculations a	re con		case a che	Test no.		Sample weight 49.70 Date 10/10/03
NOTE: S	Total	560	alculations a	re con	Percent passing	case a che	Test no.		Moisture correction
NOTE: S	Total Save all mate	560 erial until ca	Station Individual	re con	Percent		Test no.	3 NV	Moisture correction Plus #4 moisture sample
NOTE: S it name	Total Save all mate	560 erial until ca	Station  Individual percentage	re con	Percent passing	Specs	Test no.	3 NV NP	Moisture correction Plus #4 moisture sample Wet weight 1587.0
NOTE: S Pit name Sleve	Total Save all mate	560 erial until ca	Station Individual percentage	re con	Percent passing	Specs	Test no. Liquid limit Plastic limit Plastic index	3 NV NP	Moisture correction Plus #4 moisture sample Wet weight 1587.0 Dry weight 1545.0
NOTE: S Pit name Sleve	Total Save all mate	560 erial until ca	Station Individual percentage  0.0 0.0 3.9	re con	Percent passing	Specs	Test no. Liquid limit	3 NV NP	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0
NOTE: \$ it name Sieve 2 1/2 2 1 1/2	Total Save all mate Wetwt.  2 1.92 12.20	Dry wt.	Individual percentage  0.0 0.0 3.9 24.7	re con	Percent passing	Specs	Test no. Liquid limit Plastic limit Plastic index	3 NV NP NP N/A	Moisture correction Plus #4 moisture sample Wet weight 1587.0 Dry weight 1545.0
NOTE: \$ it name  Sieve  2 1/2 2 1 1/2 1 1/2 1 3/4	Wet wt	Dry wt	Individual percentage  0.0 0.0 3.9 24.7 33.3	re con	Percent passing  100 100 96.1 75.3 66.7	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value	3 NV NP	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584
NOTE: Sit name Sieve 2 1/2 2 1 1/2 1 1/2 1 3/4 1/2	Total Save all mate Wetwt.  2 1.92 12.20	Dry wt.  1.87 11.88 16.03 30.16	Individual percentage  0.0 0.0 3.9 24.7 33.3 41.9	re con	Percent passing  100 100 96.1 75.3 66.7 58.1	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class.	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry, weight 560
NOTE: Seve  Sieve  2 1/2 2 1 1/2 1 1/2 1 3/4 1/2 3/8	Wet wt	Dry wt.  1 87 11 88 16.03 30.16 21.68	O.0 0.0 3.9 24.7 33.3 41.9	e con	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560  Loss 24
NOTE: Serve  Sieve  2 1/2 2 1 1/2 1 1/2 1 1/2 3/4 1/2 3/8	Wet wt	Dry wt.  1.87 11.88 16.03 30.16	Station   Individual percentage	e con	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560
NOTE: Seve  Sleve  2 1/2 2 1 1/2 1 1/2 1 3/4 1/2 3/8 + #4	Wet wt	Dry wt.  1 87 11 88 16.03 30.16 21.68	O.0 0.0 3.9 24.7 33.3 41.9 45.1 54.9		Percent passing  100 100 96.1 75.3 66.7 58.1 54.9	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560  Loss 24
NOTE: \$ NOTE:	Wet wt	Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06	0.0 0.0 0.0 3.9 24.7 33.3 41.9 45.1 54.9 45.1	#	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560  Loss 24
NOTE: \$ Pit name Sieve  2 1/2 2 1 1/2 1 1/2 1 3/4 1/2 3/8 + #4 - #4 Total	Total Save all mate  Wet wt.  1.92 12.20 16.46 20.70 22.27 27.10 22.60 49.70	Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06	0.0 0.0 0.0 3.9 24.7 33.3 41.9 45.1 54.9 45.1	# #	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2 17.5 9.3	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560  Loss 24
NOTE: S Pit name Sieve 2 1/2 1 1/2 1 1/2 3/4 1/2 3/8 + #4 - #4 Total	Total Save all mate  Wet wt.  1.92 12.20 16.46 20.70 22.27 27.10 22.60 49.70	Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06	Individual percentage  0.0 0.0 3.9 24.7 33.3 41.9 45.1 54.9 45.1 100	# #	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2 17.5 9.3	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	3 NV NP NP N/A	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560  Loss 24
Sieve 2 1/2 2 1 1/2 1 1/2 1 3/4 1/2 3/8 + #4 - #4	Total Save all mate  Wet wt.  1.92 12.20 16.46 20.70 22.27 27.10 22.60 49.70	Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06  Minus Weight (grems) 61	O.0 O.0 3.9 24.7 33.3 41.9 45.1 54.9 45.1 100	# #	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2 17.5 9.3  Percent passing 89.1	100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP N/A 80	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Qry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Qry weight 560  Loss 24  % moisture 4.3
NOTE: \$ Pit name  Sleve  2 1/2 2 1 1/2 3 1 1/2 3 1/4 1 1/2 3 1/8 + #4 - #4 Total  Vet weight  Try weight	Total Save all mate  Wet wt.  1.92 12.20 16.46 20.70 22.27 27.10 22.60 49.70  Sieve # 8 # 50	Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06	Station	# #	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2 17.5 9.3  Percent passing 89.1 38.8	100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP N/A 80	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Dry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Dry weight 560  Loss 24
NOTE: Seve  2 1/2 2 1 1/2 1 1/2 1 3/4 1/2 3/8 + #4 - #4 Total  Vet weight grams)	Total Save all mate  Wet wt.  1.92 12.20 16.46 20.70 22.27 27.10 22.60 49.70	Dry wt.  Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06  Minus to Weight (grams) 61 343 444	Station	# #	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2 17.5 9.3  Percent passing 89.1	100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP N/A 80	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Qry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Qry weight 560  Loss 24  % moisture 4.3
NOTE: \$ Pit name  Sleve  2 1/2 2 1 1/2 3 1 1/2 3 1/4 1 1/2 3 1/8 + #4 - #4 Total  Vet weight  Try weight	Total Save all mate Wet wt.  1.92 12.20 16.46 20.70 22.27 27.10 22.60 49.70  Sieve # 8 # 50 #200	Dry wt.  1.87 11.88 16.03 30.16 21.68 26.39 21.67 48.06  Minus Weight (grems) 61	Station	# #	Percent passing  100 100 96.1 75.3 66.7 58.1 54.9 45.1 40.2 17.5 9.3  Percent passing 89.1 38.8	100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP N/A 80	Moisture correction  Plus #4 moisture sample  Wet weight 1587.0  Qry weight 1545.0  Loss 42.0  % moisture 4.3  Minus #4 moisture sample  Wet weight 584  Qry weight 560  Loss 24  % moisture 4.3

			GATES				-	ode (SA#)	119		
VHE	N SPLIT	TING (	ON THE	No.	4 SIE	VE		304		Class	1
name (	Goose H	aven	Station 410	+10	1		Test no.	4	Sampl	e weight 22,35	Date 10/10/00
Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs	Liquid limit	NV			ure correction
			percentage	-	passing		Plastic limit	·		Plus #4 mois	
			***************************************	1				NP		Masi=hs	•
1/2				1	100	100	Plastic index	NP	- 1	Wet weight Dry weight	
) 		0.66	3.0	]	97.0	95-100	Soit class.	N/A		Loss	
1/2		3.32	15.0	_	82.0			17/7		% moisture	
		1.44	6.5		75.5		"R" value	90		Minus #4 mo	pisture sample
/4		1.62	7.3	-	68.2		Sampled by	80		Wet weight	<u>490.0</u>
/2 8/8		2.58	11./	-	56.5		, samples sy			Dry weight	478.0
<del>/ 0</del> - #4		1.48	0./		49.8		Tested by			Loss	12.0
#4	10.20	9.95	4.8	#8	45.0 37.9	30-60				% moisture	2.5
rotal	22.35	22 10	100.0		24.9		ł				
			100.0	#200	7 2	5-12	1				
		-	#4 wash			,	j				
et weight ams)	Sieve	Weight (grams)	Individual percentage		Percent passing						
	# 8	75	15.7		84.3				-	<i>.</i> .	, ,,
	<b># 50</b>	138	28.9		55.4	l v	Veign	ung .	Inc	divia	lually
weight ams)	#200	189	39.5		15.9	1	_	•			•
	- #200	74									
178		76	15.9								
<u> </u>	Total	478	100.0						<u> </u>		
<u> </u>	Total	478		re con	npleted in	case a che	eck is neces	ssary			M
OTE: S	Total Save all mate	478 erial until ca	100 0	re com		case a che	eck is neces	ssary 4	Sample 2	e weight 2.35	Date 10/10/03
OTE: S	Total	478 erial until ca	100 0			case a che		4	Sample 2	2.35	Date 10/10/03 ure correction
OTE: S	Total Save all mate	478 erial until ca laven	100 0 alculations a Station 410 Individual		Percent		Test no.	4 NV			ure correction
OTE: S	Total Save all mate	478 erial until ca laven	100 0 alculations a Station 410 Individual		Percent passing	Specs	Test no. Liquid limit	4 NV NP		Moist	ure correction
ote: S	Total Save all mate	478 erial until ca laven Dry wt.	100 0 alculations a Station 41( Individual percentage		Percent passing	Specs	Test no. Liquid limit Plastic limit Plastic index	4 NV		Moist	ure correction
OTE: S	Total Save all mate	478 erial until ca laven Dry wt. 0.66	Station 410 Individual percentage		Percent passing	Specs	Test no. Liquid limit Plastic limit Plastic index	4 NV NP		Moist Plus #4 mois Wet weight Dry weight Loss	ure correction
ote: S	Total Save all mate	478 erial until ca laven Dry wt.	100 0 alculations a Station 410 Individual percentage		Percent passing  100 97.0 82.0	Specs	Test no. Liquid limit Plastic limit Plastic index	NV NP NP NP	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Moist Plus #4 mois Wet weight Dry weight Loss % moisture	ure correction
OTE: S name <i>G</i> Sleve	Total Save all mate	478 erial until ca laven Dry wt. 0.66	Station 410 Individual percentage  3.0 18.0 24.5		Percent passing  100 97.0 82.0 75.5	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class.	4 NV NP NP		Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo	ure correction
OTE: S name G Sieve  2 1/2 1/2 1/4 //4	Total Save all mate	478 erial until ca laven Dry wt. 0.66	Station 410 Individual percentage  3.0 18.0 24.5		Percent passing  100 97.0 82.0 75.5 68.2	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class.	NV NP NP NP	\	Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo	ure correction
OTE: S name G Sieve  2 1/2 1/2 1/4 //4	Total Save all mate	478 erial until ca laven Dry wt. 0.66	Station 410 Individual percentage  3.0 18.0 24.5 31.8		Percent passing  100 97.0 82.0 75.5 68.2	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP NP	\	Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo	ure correction ture sample
OTE: S name <i>G</i> Sleve	Total Save all mate	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0		Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value	NV NP NP NP		Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo Wet weight Dry weight	ure correction ture sample eisture sample 490.0 478.0
OTE: S name G Sleve  2 1/2 1/2 4/4 //2 //8 #4 #4	Total Save all mate	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0 45.0	D+10	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9	Specs	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP NP		Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo Wet weight Dry weight Loss	ure correction ture sample eisture sample 490.0 478.0 12.0
OTE: S name G Sleve  2 1/2 1/2 4/4 //2 //8 #4 #4	Total Save all mate	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0	# 8 # 50	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9	\$pecs 100 95-100 30-60	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP NP		Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo Wet weight Dry weight Loss	ure correction ture sample eisture sample 490.0 478.0 12.0
OTE: S name G Sleve  2 1/2 1/2 4/4 //2 //8 #4 #4	Total Save all mate	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95 22.10	3.0 18.0 24.5 31.8 43.5 50.2 45.0 1100.0	D+10	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9	Specs 100 95-100	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP NP		Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo Wet weight Dry weight Loss	ure correction ture sample eisture sample 490.0 478.0 12.0
OTE: S name G Sleve  2 1/2 1/2 1/2 1/4 1/2 1/8 #4 #4 Fotal	Total Save all mate Soose I- Wet wt.  10.20 22.35	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95 22.10	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0 45.0	# 8 # 50	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9	\$pecs 100 95-100 30-60	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	NV NP NP NP		Moist Plus #4 mois Wet weight Dry weight Loss % moisture Minus #4 mo Wet weight Dry weight Loss	ure correction ture sample eisture sample 490.0 478.0 12.0
OTE: S name G Sleve  2 1/2 1/2 1/2 1/4 1/2 1/8 #4 #4 Fotal	Total Save all mate COOSE I Wet wt.  10.20 22.35	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95 22.10 Weight (grams)	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0 45.0 100.0	# 8 # 50	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9 24.9 7.2  Percent passing	\$pecs 100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	4 NV NP NP N/A 80	1	Moist Plus #4 mois Wet weight Loss % moisture Minus #4 mc Wet weight Dry weight Loss % moisture % moisture	ure correction ture sample  490.0 478.0 12.0 2.5
OTE: S name G Sleve  2 1/2 1/2 1/2 1/4 1/2 1/8 #4 #4 Fotal	Total Save all mate Soose I- Wet wt.  10.20 22.35  Sieve # 8	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95 22.10 Weight (grams) 75	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0 45.0 100.0	# 8 # 50	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9 24.9 7.2	\$pecs 100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	4 NV NP NP N/A 80	1	Moist Plus #4 mois Wet weight Loss % moisture Minus #4 mc Wet weight Dry weight Loss % moisture % moisture	ure correction ture sample  490.0 478.0 12.0 2.5
1/2 1/2 1/2 3/8 #4 #4 Total	Total Save all mate  COOSE I-  Wet wt.  10.20 22.35  Sieve # 8 # 50	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95 22.10  Minus Weight (grems) 75 213	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0 45.0 100.0	# 8 # 50	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9 24.9 7.2  Percent passing 84.3 55.4	\$pecs 100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	4 NV NP NP N/A 80	1	Moist Plus #4 mois Wet weight Loss % moisture Minus #4 mc Wet weight Dry weight Loss % moisture % moisture	ure correction ture sample eisture sample 490.0 478.0 12.0
OTE: S name G Sleve  2 1/2 1/2 1/2 5/4 7/2 8/8 #4 #4 Fotal	Total Save all mate Soose I- Wet wt.  10.20 22.35  Sieve # 8	478 erial until ca laven Dry wt.  0.66 3.98 5.42 7.04 9.62 11.10 12.15 9.95 22.10 Weight (grams) 75	100 0 alculations a  Station 410 Individual percentage  3.0 18.0 24.5 31.8 43.5 50.2 55.0 45.0 100.0	# 8 # 50	Percent passing  100 97.0 82.0 75.5 68.2 56.5 49.8 45.0 37.9 24.9 7.2  Percent passing	\$pecs 100 95-100 30-60 5-12	Test no. Liquid limit Plastic limit Plastic index Soil class. "R" value Sampled by	4 NV NP NP N/A 80	1	Moist Plus #4 mois Wet weight Loss % moisture Minus #4 mc Wet weight Dry weight Loss % moisture % moisture	ure correction ture sample  490.0 478.0 12.0 2.5

#### **CDOT FORM # 565 INSTRUCTIONS**

This form is a field work sheet for use when testing aggregates in accordance with CP 31 when the maximum nominal particle size is less than 3/4 in.

This procedure allows for the total dry weight (mass) of the specimen, before washing, to be determined by either drying the total specimen or correcting it to dry weight (mass) using a moisture specimen of the same gradation and approximate weight (mass) as the specimen for wash.

**Example No. 1** illustrates using a separate moisture specimen to correct the wet weight (mass) of the wash specimen to dry weight (mass).

**Example No. 2** illustrates drying the total specimen to be washed and sieved. The percent moisture may be calculated if desired.

When correcting to dry weight (mass) by the use of a moisture specimen, it is very important that the specimen for wash and the specimen for moisture be taken and weighed at the same time. It is also important that the samples be as nearly identical in weight (mass) and gradation as possible.

**NOTE:** CDOT Form #565 was revised on 01/2013. The example still depicts the previous revision date of 4/07.

SIEVE A NOT SP	NALYS	IS FOR	AGGR	EGATES	Ditnome	I-2 900s	25 S	H 7 to aven	Project code  WCR  ass R-50	
Station 258	8+15 1	3' lt.	Test# 1	3	Station 300	00+0	00 5	' rt	Test#	14
Specimen wt (dr.	<sup>y)</sup> 772.2		Date 6/	5/02	Specimen wt (di	<sup>(y)</sup> 15	5962	2.9	Date 6/	5/03
Sieve	Weight	Percent retained	Percent passing	Specs	Sieve	Weig		Percent retained	Percent passing	Specs
2"1					2"1	341	.1	2.1	97.9	
1 1/2"					1 1/2"	758	3.1	4.7	93.3	
1"					1"		7.7	10.1	89.9	
3/4"					3/4"	210	3.2	13.2	86.8	
1/2"					1/2"	269	8.7	16.9	83.1	
3/8"					3/8"	296	7.9	18.6	81.4	
#4	0.3	0	100		#4	350	3.7			
#10	39.8	5.2	94.8		#10	415	0.4	26.0	74.0	
#16	84.8	11.0	89.0		#16	486	8.7		69.5	
#40	258.2	33.4	66.6		#40	1	2.2		25.0	
#50	379.0	49.1	50.9		#50	960	9.7	60.2	39.8	
#100	577.9	74.8	25.2		#100	128	18.2	80.3	19.7	
#200	668.6	86.6	13.4		#200	142	86.8	89.5	10.5	
-#200	5.7				-#200	10.	5			
TOTAL	674.3				TOTAL	1429	97.3			
	Grada	tion Sample	Moistu	ire Sample			Grada	tion Sampl	e Moistu	re Sample
Pan ID					Pan ID		<del></del>		<u> </u>	
Pan weight Wet weight + Pa	10				Pan weight Wet weight + P	100		· · · · · · · · · · · · · · · · · · ·		
Wetweight	A		703	2.6	Wetweight	A			70	2.2
Dry weight + Par			<del>  '''</del>	0	Dry weight + Pa				- , , ,	
Dryweight	В	<del></del>	65	0.6	Dryweight	B			65	0.1
Dry wash H <sub>2</sub> 0				2.0		O 088				2.1
-#200 % H				.0		H <sub>2</sub> O				8.0
Wet weigh	nt + (100 + %	6 H <sub>2</sub> O) x 10	0 = Dry we	ight	Wet weig	ght + (	100 + 9	% H <sub>2</sub> O) x 1	00 = Dry we	
A 834.0	_+ (100 + _	<b>8.0</b> ) x 100	= в <u>77</u> 2	2.2	A 17239.	9_+(1	00 + 8	3.0 <sub>)×100</sub>	= B 159	62.9
Sampled by D	ave Buc	Tested I	•	Assad	Sampled by <b>Dave</b>			Teste	d by	Assad
NOTE: Save	all material	until calcula	ations are	complete in c	ase check is	neces	sary.	Pag	o 1 of 2 CDOT	Form #565 4/07

CDOT Form #633, Materials Sample Tag

Revision Date 05/2013

Actual required size 8" x 2 5/8" with a detachable stub and with a wire tie through a reinforced hole located on left side of the tag so as to attach to cans, bags, etc.

Paper stock as used in the past.

The example below is not to scale.

Contract ID # (Project C	<sup>ode)</sup> 11925	Material Code 403.	02.0121	Contract ID # 1192	5
Sample ID #	FS # 120027	Test # 4A		Sample ID #	
Lab Ref. #				FS # 120027	Test # 4A
Item # 403	Container 1	of 8		Station Cooley More	rison Quarry 3/4 Rock
COLORADO DEPA	RTMENT OF TRANSP	ORTATION		Depth 5'	
Materials & Geot	echnical Branch			Item # 403	
4670 N. Holly St.	Denver, Unit A			Container 1 of	8
Denver, CO 8021	6-6408	CDOT Form# 63	3 05/2013	DETACH STUB AND PLA	ACE IN CONTAINER

STA	BILON	NETEF	RECO	INSPORTATION RD OF		Project No. I	M 0253	-151	Regi	
ITEN	/I 304 /	ABC					<u>"</u> 1192	5		
				,		Proj. location	-25 S⊦	17 to V	VCR 1	
Pit name		se H	laven	Date	3/21/0	)1 Field samp	30152	Lab# 13	3 <i>A</i>	
Represer					LL NV	177176		Class		
		RADATIO		Stabilometer		78				
Seive	As rur	Scala	Set up	,	% moisture			lbs. per o	cu. ft.	
si <u>ze</u>	passing	Ocalp		% Moisture	- #4 Materia!		85×			
4"				Weight of -#	44 Material		=			
3"				Weight of H	,0		+			
				Initial H <sub>2</sub> O ac	dded	_50	)=			
2½" .				Total initial h	H <sub>2</sub> O		(A)			
<u>2"</u>						COMPA	ACTION			
11/2"				Cylinder #		3	4	5		
1"				H <sub>2</sub> O added (		65	75	70		
	100	100		Exudation pr		10000	2960	5700		
3/4"				Evudation or		796	236	454		
<u>1/2"</u>	89	89	11 %					737		
3/8"	73	73	27 %	Ht. of brique		2.41	2.40	2,42		
	47	47	53 %	Wt. cylinder	& wet sample	3275	3282	3281		
<u>#</u> 4				Cylinder tare		2115	2117	2116		
<u>#</u> 8	36			Wet wt. of sa	ample (W <sub>w</sub> )	1160	1165	1165	4444	
#1 <u>6</u>	29			<sup>1</sup> Weight of H	1 <sub>2</sub> O (C)					
#50	18			<sup>2</sup> Dry wt. (D)						
	13			<sup>3</sup> % Moisture	(M)					
#1 <u>00</u>		-		1 Density						
#200	9			Height corre	ction by wt.					
	S	et up wei	ghts			A				
-3/4" +	1/2"	121	<del></del>	Total I	DC:	STABIL I	OMETER			
-1/2" +	3/8" —	<u> 297</u>		Total load 1000	PSI 80		I			
-3/8" +	#1	583		2000	160	15	23	16	···	
	п* —	1100	<u> </u>	Displacemen		5.52	<del> </del>			
- #4		1100		"R" value			4.38	5.24		
1 (A	() + (B)	= (C)		Drainage		81(80)	77(76)	81(80)		
2 (V	(C) - (C)	=(D)		<u> </u>	e dial reading					
	C) + (D) V_) x 30.3	= (M)					<u> </u>			

### COLORADO DEPARTMENT OF TRANSPORTATION

## Granular Material Moisture - Density Report

Project ID Project

11925

Location SH 7 TO WCR 16

Source GOOSE HAVEN

Report Date Construction

F.S.# Engineer IM 0253-151 98765

Region

Glenn Frieler, Concrete/ Physical Properties Program Manager

3200

Comments

304 CLASS 6 ABC

Lab# Sp. G. Absorption 2002-0522 2.57 1.3

Lab Tests:	Me	thod: T18	30A.			 	 	
Test	#1	#2	#3	#4	#5			
Moisture	4.7	6.7	9.2	11.5		•		
Dry Density	126.4	130.2	131.1	125.6				

foisture Chart:									
%Н2О	Dry Density	%H2O	Dry Density	%H2O	Dry Density	%H2O	Dry Density		
5.0	127.1	7.2	130.9	9.4	130.8				
5.1	127.3	7.3	131.0	9.5	130.7				
5.2	127.6	7.4	131.1	9.6	130.6				
5.3	127.8	7.5	131.1	9.7	130.5				
5.4	128.0	7.6	131.2	9.8	130.3				
5.5	128.2	7.7	131.3	9.9	130.1				
5.6	128.4	7.8	131.3	10.0	129.9				
5.7	128.6	7.9	131.4	10.1	129.8				
5.8	128.8	8.0	131.4	10.2	129.6				
5.9	129.0	8.1	131.4	10.3	129.3				
6.0	129.2	8.2	131.4	10.4	129.1				
6.1	129.4	8.3	131.4	10.5	128.9				
6.2	129.5	8.4	131.4	10.6	128.6				
6.3	129.7	8.5	131.4	10.7	128.3				
6.4	129.9	8.6	131.4	10.8	128.1				
6.5	130.0	8.7	131.4	10.9	127.8		7		
6.6	130.2	8.8	131.3						
6.7	130.3	8.9	131.3						
6.8	130.4	9.0	131.2						
6.9	130.6	9.1	131.1						
7.0	130.7	9.2	131.1						
7.1	130.8	9.3	131.0	Glenn Fr	ieler				
•	Optimu	m Moisture :	8.3		ximum Dry Densit	v: 131.4			

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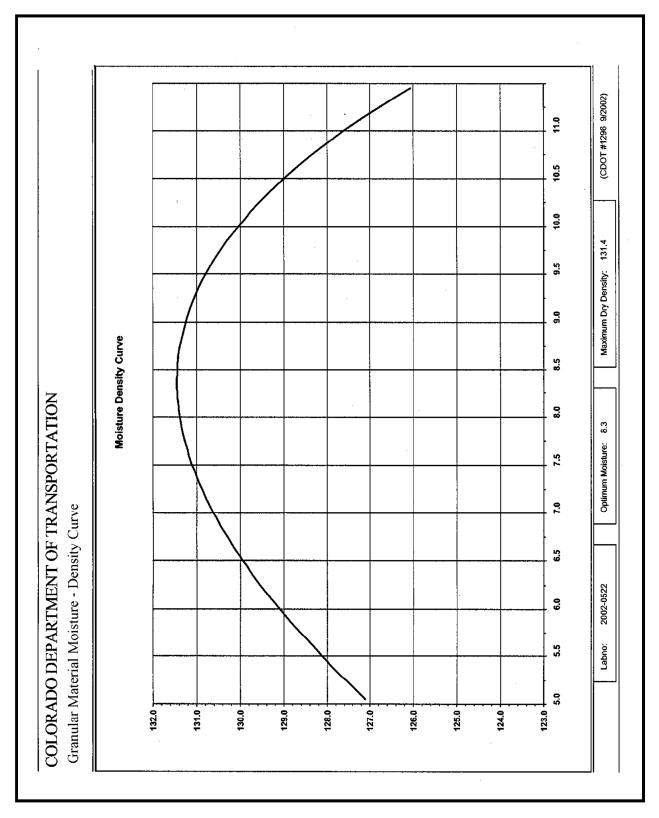
### COLORADO DEPARTMENT OF TRANSPORTATION

Granular Material Moisture - Density Report

%+4	%H2O	Dry Density	%+4	%H2O	Dry Density	%+4	%H2O	Dry Density
0	8.3	131.4	20	6.9	134.0	40	5.5	136.6
1	8.2	131.6	21	6.8	134.2	41	5.4	136.7
2	8.2	131.7	22	6.8	134.3	42	5.4	136.9
3	8.1	131.8	23	6.7	134.4	43	5.3	137.0
4	8.0	132.0	24	6.6	134.5	44	5.2	137,1
5	8.0	132.1	25	6.6	134.7	45	5.2	137.2
6	7.9	132.2	26	6.5	134.8	46	5.1	137.4
7	7.8	132.3	27	6.4	134.9	47	5.0	137.5
8	7.8	132.5	28	6.4	135.1	48	4.9	137.6
9	7.7	132.6	29	6.3	135.2	49	4.9	137.8
10	7.6	132.7	30	6.2	135.3	50	4.8	137.9
11	7.5	132.9	31	6.1	135.4	51	4.7	138.0
12	7.5	133.0	32	6,1	135.6	52	4.7	138.1
13	7.4	133.1	33	6.0	135.7	53	4.6	138.3
14	7.3	133.3	34	5.9	135.8	54	4.5	138.4
15	7.3	133.4	35	5.9	136.0	55	4.5	138.5
16	7.2	133.5	36	5.8	136.1	56	4.4	138.7
17	7.1	133.6	37	5.7	136.2	57	4.3	138.8
18	7.1	133.8	38	5.7	136.3	58	4.2	138.9
19	7.0	133.9	39	5.6	136.5	59	4.2	139.0

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